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ONTARIO

Department of Education

Courses of Study

Grades IX and X

MATHEMATICS

Issued by Authority of
The Minister of Education

COURSES OF STUDY

For

Grades IX and X (Forms I and II Lower School
and Fifth Classes)

In

Collegiate Institutes, High, Vocational and Continuation
Schools, and Public and Separate Schools

MATHEMATICS

Objectives and Suggestions

As many pupils of this grade will discontinue the study of mathematics in a year or two, the teacher should aim at giving them some realization of the place of mathematics in the life of today. As a means to this end the following objectives are suggested:

- (1) to continue the development of accuracy and facility in the use of numbers;
- (2) to develop the capacity for reasoning with abstract concepts and, with this object, to show the advantages of algebraic notation;
- (3) to make the pupil conscious of important geometric relations and of the possibility of a logical structure of geometry;
- (4) to accustom the pupil to the use of graphical representations as pictorial aids in the interpretation of statistical and other functions;
- (5) to cultivate the expression of definite ideas in precise language.

The following suggestions are presented as a guide to teachers:

- (a) As the primary result to be aimed at in all teaching of mathematics is the power to draw correct conclusions from given assumptions, the teaching should aim at developing the pupil's skill in analysing problems. Emphasis should be placed on the economy of language and accuracy of thought resulting from algebraic symbolism. Formal algebraic manipulation is a secondary consideration which is justified only by its contribution to the larger aim. Long lists of problems illustrating a single point should be discouraged, but review lists of problems involving a variety of ideas should be used.
- (b) As learning is most effective when it is the result of the pupil's own investigation, a large part of the teacher's function is to keep alive the pupil's curiosity. New ideas should be presented not as facts to be proved but rather as problems from which facts are to be discovered.
- (c) No pupil is efficient without a trained memory; a judicious use of drill material is therefore necessary. As memory training is most effective when the pupil's interest is maintained, drill problems which have reality to him are to be preferred to purely manipulative work.

- (d) As the methods and order of presentation outlined in this course are merely suggestive, it is hoped that teachers will adopt methods of correlating the work as a result of their own study and experiments.

GRADE IX

OUTLINE OF COURSE

Section 1. **Mensuration: line, square, rectangle, circle, rectangular solid, cylinder.**

English units of length; history of these units. Use of ruler in accurate construction and measurement of straight lines.

Use of dividers (or compasses) in transferring lengths. Addition and subtraction of line segments.

Numerical exercises, such as: Express 9" as a fractional and as a decimal part of a yard and the converse problem. Addition, subtraction, multiplication and division of fractions, such as $\frac{1}{2}$ of $(4\frac{5}{16}" - 3\frac{7}{8}")$.

Construction of square and rectangle by ruler, set square, etc. Formulae: $P = 2(1 + w)$, $P = 4s$, $A = lw$, $A = s^2$. Problems reviewing tables of square measure. [P = perimeter, l = length, w = width, s = side, A = area.]

Use of compasses in construction of circles. Nomenclature of the circle: centre, radius, diameter, chord, arc, sector. Formulae $c = \pi d$ and $c = 2\pi r$ developed and value of π found experimentally. (Winding strip of paper about cylinder, using ruler and two set-squares as form of calipers, etc.) [c = circumference, d = diameter.]

Use of ruler and set-square to find centre of a circle and in construction of a circle through three given points.

Area of circle and of curved surface of cylinder. Formulae $A = \pi r^2$, $A = 2\pi rh$ developed experimentally. [h = height.]

Volume of rectangular solid and of cylinder. Formulae: $V = lwh$, $V = s^2h$, $V = s^3$, $V = \pi r^2h$. [V = volume.]

Numerical exercises, such as: If the area of a square is 144 sq. in. find its side and perimeter. Find the difference in perimeter between a square and a rectangle of equal area whose sides are 9' by 4'. If a cylinder whose diameter is 8" has the same cubical contents as a rectangular solid 6" $\times$ 6" $\times$ 10", calculate the height of the cylinder.

Problems without numbers, such as: If the side of a square is tripled, what is the effect on the area? If the edge of a cube is halved, what happens to the volume? What effect on the circumference and on the area of a circle is produced by doubling the radius?

Metric units of length—linear, square and cubic measures (restricted to common units). Units of weight and liquid measure. History of units. Formula $i = 2.54c$ developed by exercises in measurement. [i = inch, c = centimetre.]

Conversion from English to metric units and vice versa.

Problems using both English and metric units, using integers, fractions and decimals, and stressing the advantage of decimal notation in computation.

Simple problems in square and cube root (by method of factoring only).

Indirect use of a formula (solving simple equations but without introducing formal methods or terminology), such as: Given the area and the width, find the length.

Supplementary topics (to be taught if time permits):

History and meaning of other units of length: cubit, span, fathom, nautical mile, etc.

Section 2. Decimals and Percentage

Arabic system of numeration. The decimal point. Comparison of 7.75 and .0075, etc.

Addition, subtraction, multiplication, division and simple roots of decimal fractions.

Short methods of calculation reviewed and extended. Stress need for accuracy. Methods of checking, including checking by estimation.

Practice in expressing vulgar fractions and mixed numbers in decimal notation, and converse problems.

Significance of digits in numbers obtained by measurement and in numbers obtained in calculation from measurements. (Significant figures.)

Problems: decimal notation employed in problems based on measurement and cost of electricity and measurement of density (without formal terminology), expansion per unit length, etc.

Changing decimal and vulgar fractions to percentages, and converse problems.

Problems involving simple applications of percentage. Use of formulae.

Supplementary topics (to be taught if time permits):

History of Arabic system of numeration.

Roman and other systems; methods of performing fundamental operations in these systems.

Expressing fractions with denominators 3, 6, 7, 9 as recurring decimals. What fractions produce terminating decimals? recurring decimals? Maximum number of digits in the period of a recurring decimal.

Expressing a recurring decimal as a fraction.

Composite notations: $7\frac{1}{7}\%$, $.08\frac{1}{3}$, etc.

Section 3. Algebraic Notation, Simple Equations

Constants: integers and fractions (3 types).

General numbers: use of x , y , z , etc., to represent abstract numbers.

Nomenclature of algebra introduced: coefficient, index, term, expression.

Use of operation symbols and brackets.

Meaning of x^2 , xy , m^3 , y^2z , etc., made clear by numerical and geometric illustrations.

Correlation of arithmetical and algebraic notations and operations to be stressed.

Equations of first degree in one unknown; practice in constructing and solving such equations by means of axioms; integral, fractional and decimal coefficients to be used; positive roots only; verification of solutions.

Formulae reviewed and extended; calculations based on formulae; construction of tables from formulae.

Section 4. **Graphs and Simple Geometry**

Graphs:

Use of squared paper; scale drawings based on rectangle and square; numerical problems.

Simple graphs: bar graph, broken-line graph, rectangular distribution graph.

Graphs of simple formulae, such as:

$c = 5n$ (cost of a number of articles at 5c. each)

$c = 25n + 15$ (similar to previous plus a constant, say 15c. for car fare).

$i = 2.54c$. (changing a measurement in centimetres to inches).

$v = kr^2$ (volume of cylinder of any radius).

$1w = 24$ (area of rectangle is constant).

Contrast graphs of these formulae with examples of broken-line graphs, stressing the "smoothness" of the graphs derived from equations.

Geometry: angle, vertex and arms of an angle.

Classification: right, acute (sharp), straight, obtuse (blunt).

Construction and measurement of angles by protractor; unit of measurement.

The degree.

Sum of the angles in any triangle derived by measurement and demonstrated experimentally.

Circular distribution graphs.

Relation of arc and sector to angle at centre of circle.

Exercises reviewing the mensuration of the circle.

Section 5. Directed Numbers

The use of plus and minus as signs of direction or quality made clear by applications to loss and gain, temperatures above and below zero, etc.

Reading of graphs showing monthly balances, temperature records, a ship's course in N. and S. latitudes, etc.

Graphs of positive, zero and negative numbers along a straight line; calculation of distances between two points on the same side or on opposite sides of zero (each example to be illustrated by diagram on graph sheet); integral and decimal notations to be used.

Stress the use of *positive* and *negative* to signify opposite concepts; examples based on motion forward and backward (rugby game), loss and gain, etc., requiring the addition of numbers with like and unlike signs.

Section 6. Addition and Subtraction

Addition and subtraction of expressions not exceeding three terms.

Insertion and removal of brackets in problems involving addition and subtraction.

Practice in simplifying and solving simple equations having positive and negative roots.

Checking of algebraic additions and subtractions by substitution of numerical values.

Section 7. Multiplication and Division

Multiplication and division of directed numbers.

Rule of signs developed.

Review of meaning of positive integral index; formulation of index laws for multiplication and division.

Multiplication (with geometric illustrations) of binomials by monomials and of binomials by binomials, as:

$$\begin{aligned}a(x+y) &= ax+ay; (a+b)(x+y) = ax+ay+bx+by; \\(a+b)^2 &= a^2+2ab+b^2.\end{aligned}$$

Division by monomials and binomials.

Application of index laws to powers of integers.

Checking of products and quotients by substitution of positive and negative values.

Analysis of steps employed in multiplying 47×35 and 4.7×3.5 from the product of $(4x+7)(3x+5)$; short method of performing arithmetical multiplications of this type.

Section 8. Simple Factoring and Application to Operations with Fractions

Factoring of simplest type forms, such as: common factor, difference of squares of binomial type trinomials with coefficient of first term unity, including complete squares.

Arithmetical and geometrical applications of factoring, such as: simplifying 93×87 , $69^2 - 31^2$, $\sqrt{37^2 - 12^2}$, etc., calculating area of a path or annulus.

Least common multiple.

Reduction, addition, subtraction, multiplication and division of simple fractions; correlation with similar operations using arithmetical fractions.

Section 9. Practical Applications of Geometry

Construction of triangle by ruler and compasses given lengths of three sides.

Classification of triangles by sides.

Construction of triangle by ruler and protractor given two sides and contained angle, or two angles and one side.

Classification of triangles by angles.

Similar triangles; equality of ratios of corresponding sides deduced from measurements; application to calculation of heights and distances.

Pythagorean relationship in right-angled triangle deduced from cutting sum of two squares and tested by measurement.

Construction of the 30° , 60° , 90° triangle and of the 45° , 45° , 90° triangle.

Problems based on Pythagorean theorem, such as: calculation of length of rafter, distance *as crow flies*, etc.

Formal arithmetical square root taught from the identity $x^2 + 2xy + y^2 = (x+y)^2$ (illustrated geometrically); problems limited to exact squares not exceeding six digits.

Use of square root tables; estimation of approximate square roots and checking by multiplication. (The short method of calculation 34.6^2 from 34^2 should be reviewed; also degree of accuracy of the product—significant digits.)

Mensuration of the triangle, parallelogram and trapezoid with general formulae.

Supplementary topics (to be taught if time permits):

Geometrical designs based on straight line and circle.

Construction and use of simple instruments for indirect measurement.

Section 10. Equations

Equations of the first degree in one unknown.

Solution by axioms reviewed.

Transposition rule introduced.

Literal coefficients used in simplest types.

Practice in translating statements into equations and equations into statements.

Problems solvable by first degree equations.

Section 11. **Geometry and Mensuration**

Accurate constructions with ruler and compasses. Emphasis on ability to describe a construction in good geometrical language.

Bisection of straight lines.

Bisection of angles.

Construction of an angle equal to a given angle.

Drawing of perpendiculars and of parallel straight lines.

Simple inferences based on axioms.

REFERENCE BOOKS AND ALLOTMENT OF TIME

The text-books for pupils' use are:

General Mathematics—Book I, Jackson, Dean and Crawford (Macmillan Co. of Canada, Ltd.).

Mathematics for Technical Schools (authorized for Vocational classes only).

The following estimate of time required for the various sections of the course and references to recommended text-books are for the guidance of the teachers:

SEC- TION	ESTIMATED PERIODS	TIME WEEKS	REFERENCES
1	12	3	No text covers this section. The teacher should prepare his own. Help may be had from parts of Mathematics for Technical Schools (The Copp, Clark Co., Ltd.), Chap. IV and pp. 205-6, 208, and from Geometry for High Schools (The Macmillan Co., Ltd.) pp. 5-11.
2	8	2	Mathematics for Technical Schools, Chap. III.
3	16	4	Ontario High School Algebra (The Macmillan Co., Ltd.), Chaps. I and II.
4	5	3	Mathematics for Technical Schools, Chap. IX, pp. 119-135
	4		Geometry for High Schools, pp. 12-24.
	3		Mathematics for Technical Schools, p. 132 and pp. 97-101.
5	4	1	Ontario High School Algebra, Chap. III.
6	8	2	Ontario High School Algebra, Chap. IV.
7	12	3	Ontario High School Algebra, Chap. V.
8	20	5	Ontario High School Algebra, Chaps. VIII and IX.
9	3	4	Geometry for High Schools, pp. 31-34.
	9		Modern Junior Mathematics (D. C. Heath & Co.), Book II, Section 14, pp. 246-258.
			Mathematics for Technical Schools, pp. 62-66.
	4		Mathematics for Technical Schools, pp. 87-91.
10	14	3½	Ontario High School Algebra, Chap. VI.
11	10	2½	Geometry for High Schools, p. 21, pp. 26-38.
Total 132		33	

GRADE X

OUTLINE OF GENERAL COURSE

Section 1. Review and Extension of Algebraic Operations

Review of algebraic notation and of the four fundamental operations. Correlation with arithmetical operations.

Checking of results by the substitution of numerical values and by other means.

Use of brackets as they occur in practice, avoiding *nests* of brackets.

Expansions, by inspection, of squares and cubes of binomials and of squares of trinomials, such as $(2a-b)^2$, $(x+y)^3$, $(a+b+c)^2$.

Section 2. Equations

Review of solution of equations of the first degree in one unknown.

Solution of a system of two equations of the first degree in two unknowns, using the method of elimination by addition or subtraction. Examples with integral, fractional and decimal coefficients. Graded problems requiring the solution of these equations.

Section 3. Graphs

The method of graphical representation by means of perpendicular axes.

Plotting of points from their co-ordinates. Plotting of rectangles, triangles, quadrilaterals from the co-ordinates of their vertices. Measurement of perimeters and areas. Calculation of perimeters and areas in simple cases.

Examples of graphs in which two variables are involved, such as temperature charts, barometric pressure charts, rainfall charts, wheat production, gold production, exports, imports, elevations above sea level, etc.

Graphical solution of simple problems in two variables. (Such examples as involve: the amount of a sum of money at simple interest with variable time; distances covered at constant speeds; place or time of meeting of two travellers under given conditions; cost or selling price of variable amounts at a given rate; variation of the cost of a given article with the time for uniformly rising or falling prices, etc.)

The technique of graphs. Use of the terms origin, axes, quadrants, co-ordinates (positive and negative).

Consideration of the fact that two variables are involved in the graphs drawn. Discussion of the *variable point* (x, y) . Conditions that the point (x, y) lie: above the axis of x , in the second quadrant, on the axis of x , 3 units to the left of the axis of y , equidistant from the axes, twice as far from the axis of x as from the axis of y , etc.

Graphs of straight lines and simple curves from such equations as $y = x$, $y = 3x$, $y = 3x - 2$, $x + y = 5$, $x^2 + y^2 = 25$, $y = x^2$. Study of the resulting graphs, first by considering each graph as outlined by plotted points, and second by considering each graph as a path traced by a moving point whose co-ordinates x and y for every position of the point satisfy the given equation.

Graphical illustration of the solution of a system of two equations of the first degree in two unknowns.

Use of the graphical method in solving such pairs of equations as $y = x^2$, $y = 2x + 15$; $y = x^2$, $y = 4x - 2$. Limitation of the method of graphical solution (results in general approximate). Checking of results obtained graphically.

Graphical demonstration that a system of two equations of the first degree in two unknowns may have no solution *or* one solution *or* an unlimited number of solutions.

Section 4. **Factoring of Polynomials with Applications**

Review and extension of factoring to include the following types: polynomials in which a common factor is obtained by inspection or by grouping of terms; trinomials with binomial factors; perfect squares; differences of squares; polynomials which reduce to the difference of squares on completing a square; sum and difference of cubes. (It is recommended that work in factoring should, for the majority of pupils, be confined to problems which are relatively simple and of frequent occurrence in later work; also that a selection of more difficult problems be available for the enjoyment of pupils with a bent for mathematics.)

Simple applications of factoring. Highest common factor. Lowest common multiple. Use of factors in operations with fractions and in simplifying equations. Solution of easy quadratics by factoring. Condition that a factor may be divided out from equation.

Supplementary topic: method of finding H.C.F. by the theorem of differences with applications in arithmetic and in algebra.

Section 5. **Synthetic Geometry**

The following propositions with exercises thereon from Geometry for High Schools.

Book I. Propositions 1 to 24, inclusive.

Book II. Propositions 1 to 5, inclusive, and proposition 14.

NOTE:—This part of the course, more than any other, gives an opportunity to develop an understanding of deductive reasoning and skill in using such reasoning. To take full advantage of this opportunity the pupil should spend the greater part of his time in analyzing and solving problems.

Section 6. **Numerical Trigonometry**

Drawing to different scales: squares, rectangles, triangles, circles. Application of the idea of magnification to infer the equality of ratios of corresponding lines in similar figures.

Meaning of sine, cosine and tangent of an acute angle. Determination of these ratios for given angles by measurement.

Simple problems involving the ratios of the sides of the 30°, 60°, 90°, and the 45°, 45°, 90° triangles, and of right-angled triangles the measures of whose sides are simple integers.

Use of tables (with angles at intervals of one degree) of sine, cosine and tangent in the solution of problems in heights and distances based on right-angled triangles.

Section 7. Mensuration and Related Topics

Review of mensuration of Grade IX.

Formula for the area of a triangle in terms of the sides. This formula may be tested by application to right-angled triangles and by comparison of results with those found from the formula $A = \frac{1}{2}bh$. The proof may be given at the discretion of the teacher, but should not be required from the pupils.

Calculation of the altitude of a triangle whose sides are given.

Finding the surface and volume of simple prism, simple pyramid, cone, sphere. Formulae may be obtained experimentally or otherwise.

Drawing the plan, elevation and simple sections of triangular prism, pyramid, cylinder, cone and sphere.

Problems involving correlation of geometry, trigonometry and mensuration, such as (a) finding the slant height of a square pyramid given the base and vertical height, (b) finding the radius of the base and the volume of a right circular cone given the vertical height and the angle at the vertex, (c) demonstrating that if each side of a triangle is doubled its area is quadrupled.

Supplementary topic: drawing plans and elevations for more complicated solids.

Reference Books and Allotment of Time

The following estimate of time required for the various sections of the course and references to recommended text-books are for the guidance of the teachers:

SEC- TION	ESTIMATED PERIODS	TIME WEEKS	REFERENCES
1	12	2	Ontario High School Algebra, Chap. X and sections 64, 93 (operations with detached coefficients not included).
2	15	2½	Ontario High School Algebra, Chap. VII.
3	18	3	Ontario High School Algebra, Chap. XIII Mathematics for Technical Schools, Chap. IX. Elementary Course of Mathematics (Hall and Stevens). (New edition, including easy graphs.)
4	21	3½	Ontario High School Algebra, Chap. XI and sections 132, 136, 137, 138, 141 (Sections 101, 102 not included.)
5	108	18	Geometry for High Schools (specified parts of Books I and II).
6	18	3	Modern Junior Mathematics (D C Heath & Co.), Book III, Chap. XII. Junior Mathematics for Today (Ginn & Co.), Book III, Chap. VIII.
7	18	3	Ontario High School Arithmetic, Chap. IX. Mathematics for Technical Schools, Chaps. VII and XII.

OUTLINE OF SPECIAL COURSES

INDUSTRIAL AND AGRICULTURAL COURSE

Section 1. Arithmetic

Oral and written drill on operations with whole numbers, vulgar and decimal fractions, stressing the latter; short and frequent improvement tests, the pupil drawing the graph of his own score and of the median for the class.

An introduction to the treatment of numbers derived from measurement: meaning of accuracy, significant figures, possible error, percentage error. Contracted methods of multiplication and division.

Ratio considered as a fraction; proportion as the equality of fractions.

Graphs of simple formulae.

Effect on areas and volumes due to a change in dimensions

Section 2. Geometry

The geometry of Grade IX reviewed and extended to include an experimental study of the following topics: relation of interior and exterior angles of a triangle; equality of triangles, bisection of angles and straight lines, construction of perpendicular from point to straight line, construction of angles equal to given angles; parallel lines relationships; division of a line into any number of equal parts; regular polygon; equivalence of areas in simple figures.

Section 3. Mensuration

Area of a parallelogram, area of a triangle in terms of its base and altitude, area of a triangle in terms of the sides, area of a trapezium, area and circumference of a circle, area of circular ring or annulus, length of the arc of a circle.

Section 4. Algebra

Review of linear equations in one unknown with problems.

Solution of a system of linear equations in two unknowns with problems.

Graphs of equations of the first, second and third degrees.

Section 5. Trigonometry

Definition of three principal trigonometric ratios. The use of tables in the solving of right-angled triangles. Correlation with indirect measurement.

Section 6. Additional Topics

NOTE:—Where pupils have selected the special course they wish to pursue, additional work should be given in the mathematics of these subjects as outlined below. Where no selection has been made, the chapter on the building trades (Mathematics for Technical Schools) should be taught.

(a) **Machine Shop Practice; Automobile Mechanics; Mechanical Draughting**

Use of calipers, micrometer, vernier.

Cutting and grinding speeds. Ratios of pulleys and gears.

Taper: taper expressed in inches per foot, taper represented as an angle, kinds of standard tapers, calculations essential to the turning of tapers, using the offset and compound rest methods.

Threads: terminology, formula, thread tables as applied to the American National Threads; gauging of threads for tap and die sizes, selection of drill sizes for tapped holes

(b) **Applied Electricity**

Graphs of electrical formulae. Substitution in simple formulae. Calculations involving circular and square mil wire measure. Problems in estimating elementary quantities, such as bills of materials for wiring installations, electrical loads in typical small installations and number of circuits required, cost of heating water and heater capacities required. Use of manufacturers' hand-books should be encouraged

(c) **Woodwork; Sheet Metal; Architectural Draughting**

Simple gable roof. Elementary problems in estimating: specifications, bills of materials, and approximations, use of hand-books for dimensions of standard size materials.

(d) **Applied Chemistry**

Use of formulae, graphs of physical chemistry relations. Elementary problems, such as percentage composition, proportions in mixtures and solutions, weights derived from volumes and densities.

(e) **Other Special Courses**

Mathematics for aircraft, mining and other special courses should be arranged to suit local needs.

NOTE:—Solutions of problems should be set up in neat, tabulated forms. Calculations for each problem should appear in neat, approved form on the same page as the solution.

Reference Texts

Mathematics for Technical Schools (The Copp Clark Co., Ltd.).
Exercises in Experimental Geometry (The Copp Clark Co., Ltd.).

HOME ECONOMICS COURSE

Section 1. **Arithmetic**

Oral and written drill on fundamental operations; improvement tests, plotting graphs of individual scores against the median for the class.

Problems related to transactions of the home: food and meal costs; buying and furnishing a home; upkeep and repair; reference to electrical units for calculating electric bills; other public utility bills; comparative costs of ready-made and home-made garments.

Application of problems in percentage: comparative costs of cash and instalment buying; cash discount; taxation; insurance; budgets; bank interest; duties and customs.

Domestic exchange: money orders; bank drafts.

Section 2. **Mensuration**

Review of the terminology included in the mensuration of the Grade IX course; continued and accurate use of such tools as the ruler, compass and set-square. This work should be related to dress design, pattern study and home decoration. Calculation of the areas of surfaces and comparative costs of various floor and wall finishes.

Section 3. **Graphs and Charts**

Construction and interpretation of graphs and charts related to the home, such as accidents in the home; time budgets; personal and family budgets; height and weight records of children; food consumption; composition of food; temperature records of a patient cared for at home. Data may be obtained from current statistical records.

Section 4. **Algebra**

Linear equations in one unknown reviewed, with problems. Solution of a system of linear equations in two unknowns, with problems.

Reference Text

Vocational Arithmetic for Girls (The Macmillan Co.).

ART COURSE

Section 1. **Arithmetic**

A series of short (four-minute) improvement tests on fundamental operations with integers, vulgar and decimal fractions; drill and remedial exercises where required.

Percentage and its application to discounts and commissions, profit and loss and insurance; instalment buying and its relation to interest.

Section 2. **Geometry**

Use of straight edge, dividers, right triangles and T-squares in accurate geometrical measurement. Useful geometrical constructions: bisecting line, angle, etc. Transfer of figures.

The principle of symmetry as a basis for design; designs based on geometrical figures.

Scale drawing; plan reading and reconstruction; division of lines into a number of equal parts; ratio and proportion; enlarging and reducing drawings in a given ratio.

Rectangular proportion; elements of dynamic symmetry.

An experimental approach to perspective as a "geometry of illusion."

Analysis of commercial objects (stoves, cars, etc.), buildings, furniture, etc., to show applications of geometry in everyday life.

COMMERCIAL COURSE

Section 1. Algebra

Review of Grade IX course, with special attention to simple equations.

Solution of a system of two equations of the first degree in two unknowns, using the method of elimination by addition or subtraction. Examples with integral, fractional and decimal coefficients. Graded problems requiring the solution of these equations.

Use of graphs for representing and interpreting statistical data. Use of formulae such as occur in simple mensuration and in commercial arithmetic.

Section 2. Arithmetic

Work of Grade IX reviewed and extended, due stress being given to fractions, decimals and square root.

Percentage: use of fractions and decimals in solving problems. Percentages should be expressed in simple fractions or as decimals, whichever is more convenient.

Practical problems in billing, pay-rolls, trade discount, profit and loss, insurance (fire, accident, life, automobile, etc.), taxes (municipal, income, duties, customs), commission, bank interest, bank discount.

Domestic exchange: money orders, bank drafts, etc.

Compound interest, interest tables.

Rapid calculation: accurate and rapid calculation in addition, subtraction, multiplication and division of integers, fractions, decimals; commercial problems involving percentage.

NOTES:—(1) Rapid calculation should be taught throughout the school year by taking part of some mathematics periods to give pupils the necessary practice and facility in handling numbers.

(2) Solutions of problems should be set up in neat, tabulated forms, preferably in ink. Calculations for each problem should be shown in neat, approved form on the same page as the solution.

Reference Texts

A Commercial Arithmetic for Secondary Schools (The Ryerson Press).
Canadian Business Arithmetic, Part I (Sir Isaac Pitman and Sons).